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(54) ROTARY DAMPER TYPE HYDRAULIC BUFFER SYSTEM

(57) The present invention discloses a hydraulic buffer system with a rotary damper. The hydraulic buffer system comprises the rotary damper, a first oil path and a second oil path, wherein the rotary damper comprises a stator, a rotor and a hydraulic cavity formed between the stator and the rotor; a first oil way and a second oil way are formed on the stator, and the hydraulic cavity comprises a first cavity and a second cavity which are respectively communicated with the first oil way and the second oil way; when the rotor rotates anticlockwise, hydraulic oil in the first cavity is compressed and then enters into the second cavity from the first cavity after flowing through the first oil way, the first oil path and the second oil way; and when the rotor rotates clockwise, the hydraulic oil in the second cavity is compressed and then enters into the first cavity from the second cavity after flowing through the second oil way, the second oil path and the first oil way. The hydraulic buffer system with the rotary damper is high in integration level and has a good buffer effect; and by means of oil suction valves as well as end surface sealing and axial surface sealing, no appearance of a leakage phenomenon is ensured.

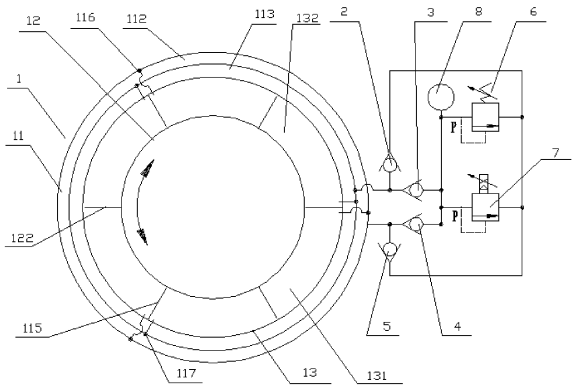

Fig. 1

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Description

TECHNICAL FIELD

[0001] The present invention relates to the technical field of damping vibration attenuation control systems for vehicles, in particular to a hydraulic buffer system with a rotary damper.

BACKGROUND ART

[0002] With the rapid development of automobile manufacturing industry in China, various vehicle manufacturing industries are also advancing by leaps and bounds, and articulated coaches are gradually generalized in large and medium-sized cities in China owing to the characteristics of large passenger capacity, high utilization factor and the like. The articulated coach is generally composed of a front carriage, a rear carriage, a chassis articulation system for connecting the front carriage with the rear carriage, and the like, wherein the chassis articulation system comprises a front frame, a rear frame, a turntable bearing, a hydraulic buffer device and the like, the front frame is generally fixedly connected with the front frame of the articulated coach by means of a front crossbeam, and the rear frame is fixedly connected with the rear carriage of the articulated coach by means of a rear crossbeam.

[0003] Wherein, the hydraulic buffer device in the chassis articulation system acts as a key factor for restricting the performances of the articulated coach. The hydraulic buffer device of the articulated coach generally consists of a left hydraulic cylinder, a right hydraulic cylinder, a hydraulic controller and an electric control system wherein the amplitude of the output resistance of the hydraulic cylinder is converted under the control of the hydraulic controller, and the electric control system sends a signal to the hydraulic controller according to the angle of turn of the vehicle, so that different pressure values can be converted by the hydraulic controller. Although the hydraulic buffer control system can form different damping according to the change of an included angle of the vehicle, the structure of the system is relatively complicated, and the left hydraulic cylinder and the right hydraulic cylinder are stressed unbalancedly and occupy a large space; and in addition, an oil leakage phenomenon occasionally happens at a joint of a hydraulic component and a pipeline, such that the performances of the vehicle are affected, and the vehicle will be caused not to run in a severe case.

SUMMARY OF THE INVENTION

[0004] The invention aims to overcome of the defects of the prior art, and an object thereof is to provide a hydraulic buffer system with a rotary damper for a purpose of improving the buffer effect of the rotary damper.

[0005] In order to achieve the above objectives, the present invention is emboded by the follow technical solution: the hydraulic buffer system with the rotary damper comprises the rotary damper, a first oil path and a second oil path, wherein the rotary damper comprises a stator, a rotor capable of rotating relative to the stator and a hydraulic cavity formed between the stator and the rotor; a first oil way and a second oil way are formed on the stator, and the hydraulic cavity comprises at least one first cavity and at least one second cavity which are communicated with the first oil way and the second oil way respectively; when the rotor rotates anticlockwise, hydraulic oil in the first cavity is compressed, and the hydraulic oil enters into the second cavity from the first cavity after flowing through the first oil way, the first oil path and the second oil way; and when the rotor rotates clockwise, the hydraulic oil in the second cavity is compressed, and the hydraulic oil enters into the first cavity from the second cavity after flowing through the second oil way, the second oil path and the first oil way.

[0006] Preferably, the buffer system also comprises a first one-way valve, a second one-way valve, a third one-way valve, a fourth one-way valve and a proportional overflow valve, wherein the second one-way valve, the proportional overflow valve and the fourth one-way valve are sequentially connected in series to form the first oil path; and the third one-way valve, the proportional overflow valve and the first one-way valve are sequentially connected in series to form the second oil path.

[0007] The buffer system also comprises an overflow valve and a pressure sensor, wherein the overflow valve and the proportional overflow valve are connected in parallel and are then connected between the second one-way valve and the fourth one-way valve in series; and the pressure sensor is connected with the overflow valve and the proportional overflow valve in series and is configured to detect the pressure at a port of the overflow valve and the pressure at a port of the proportional overflow valve.

[0008] The rotary damper also comprises an upper end cover and a lower end cover which are configured to package the stator and the rotor.

[0009] The circumferential surface of the inner wall of the stator is equipped with at least one partition board groove, wherein a partition board is fixedly arranged in the partition board groove, the outer wall of the stator is equipped with a first oil port and a second oil port which are symmetrical and are respectively located in both sides of each partition board, and the first oil port and the second oil port are communicated with the first oil way and the second oil way respectively.

[0010] The bottom of the partition board groove is equipped with a compaction oil groove.

[0011] The end surface of the stator and the end surface of the rotor are equipped with a sealing groove respectively.

[0012] The circumferential surface of the outer wall of the rotor is equipped with at least one blade groove, wherein a blade is fixedly arranged in each blade groove,

and an oil suction valve mounting port is configured in each of both sides of each blade.

[0013] The at least one first cavity and the at least one second cavity of the hydraulic cavity are formed by the partition boards and the blades in a spacing manner.

[0014] The hydraulic buffer system of the rotary damper also comprises a hydraulic integration block, and all the oil paths and valve equipment are arranged in the hydraulic integration block.

[0015] The present invention has the beneficial effects that:

1. The pressure control is simple, and the electric control unit supplies a linear voltage to the proportional overflow valve according to different vehicle velocities and angles, so that the damping force of the damper linearly increases with the increase of the vehicle velocity and the angle; due to the adoption of multiple sealing and the mounting of the oil suction valves, basically no oil leakage is ensured; and when the electric control system has a fault, basic damping can be used.

2. The manufacturing cost is low, the maintenance and mounting are convenient, no expensively processed integration device or a rotary valve needing high manufacturing and processing precision is required to be used, and therefore the manufacturing cost is greatly reduced and the competitiveness on the market is improved.

3. Stepped voltage regulation can be realized, and different working pressures of the rotary damper can be set according to different circumstances, and thus the safety coefficient is high.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016]

FIG.1 is a principle diagram of the hydraulic buffer system with the rotary damper of the present invention.

FIG.2 is a stereoscopic schematic diagram of the rotary damper of the present invention.

FIG.3 is a stereoscopic schematic diagram after the upper end cover is removed from the rotary damper of the present invention.

FIG.4 is a stereoscopic structure schematic diagram of the stator of the present invention.

FIG.5 is a plane structure schematic diagram of the stator of the present invention.

FIG.6 is a stereoscopic structure schematic diagram of the rotor of the present invention.

FIG.7 is a plane structure schematic diagram of the rotor of the present invention.

FIG.8 is a stereoscopic structure schematic diagram of the integration block in the specific embodiment of the present invention.

[0017] In the drawings, the rotary damper 1, the stator 11, the flange surface 111, the first oil way 112, the second oil way 113, the partition board groove 114, the partition board 115, the first oil port 116, the second oil port 117, the sealing groove 118, the compaction oil groove 119, the rotor 12, the blade groove 121, the blade 122, the end surface sealing groove 123, the axial surface sealing groove 124, the oil suction valve mounting port 125, the hydraulic cavity 13, the first cavity 131, the second cavity 132, the upper end cover 14, the lower end cover 15, the first one-way valve 2, the second one-way valve 3, the third one-way valve 4, the fourth one-way valve 5, the overflow valve 6, the proportional overflow valve 7, the pressure sensor 8, the sealing ring 9 and the hydraulic integration block 10 are marked.

DETAILED DESCRIPTIONS OF THE PREFERRED EMBODIMENTS

[0018] The technical solution of the embodiment of the present invention will be described clearly and completely below in conjunction with the attached drawings of the present invention.

[0019] As shown FIG.1, the hydraulic buffer system with the rotary damper disclosed by the present invention comprises the rotary damper 1, a first one-way valve 2, a second one-way valve 3, a third one-way valve 4, a fourth one-way valve 5, an overflow valve 6, a proportional overflow valve 7 and a pressure sensor 8, wherein the rotary damper 1 comprises a stator 11, a rotor 12 capable of rotating relative to the stator and a hydraulic cavity 13 formed between the stator 11 and the rotor 12; the rotor 12 is positioned on the inner side of the stator 1l and is concentric with the stator 11; and a first oil way 12 and a second oil way 113 are configured on a flange surface 111 of the upper end of the stator 11 in the circumferential direction. The hydraulic cavity 13 comprises at least one first cavity 131 and at least one second cavity 132 which are communicated with the first oil way 112 and the second oil way 113 respectively.

[0020] Wherein, the second one-way valve 3, the proportional overflow valve 7 and the fourth one-way valve 5 are sequentially connected in series to form the first oil path, and the third one-way valve 4, the proportional overflow valve 7 and the first one-way valve 2 are sequentially connected in series to form the second oil path.

[0021] As a safety valve of the system, the overflow valve 6 is configured to set the safety pressure of the system, and the pressure value of the overflow valve 6

can be set manually; and when an electric control system has a fault to cause power failure of the system, the overflow valve 6 provides basic damping for the rotary damper 1 so as to support the vehicle to run to a repair factory, and the basic damping force can be regulated manually in case of needing to be regulated in a driving process, and thus a safety protection effect is achieved.

[0022] The overflow valve 6 and the proportional overflow valve 7 are connected in parallel and are then connected in series between the second one-way valve 3 and the fourth one-way valve 5; the pressure sensor 8 is connected with the overflow valve 6 and the proportional overflow valve 7 in series and is configured to detect the pressure at a port P of the overflow valve 6 and the pressure at a port P of the proportional overflow valve 7 and transmit detected data to an electric control unit, a computer is configured to compare the detected pressure value with a pressure value set by the system, and if the detected pressure is slightly low, the electric control unit sends a signal to the proportional overflow valve 7, and the proportional overflow valve 7 increases the pressure value after receiving the signal, so that the pressure at the port P of the proportional overflow valve 7 reaches a set pressure value; and in the same way, when the detected pressure value is slightly high, the proportional overflow valve 7 correspondingly relieves the pressure to reduce the pressure value, and the proportional overflow valve 7 here can play roles of pressure regulation and safety protection at the same time.

[0023] The proportional overflow valve 7 can be replaced with a fixed hydraulic damper, and an electromagnetic valve is then additionally arranged to realize stepped pressure regulation.

[0024] As shown in FIG.1-7, the rotary damper comprises a stator 11, a rotor 12 as well as an upper end cover 14 and a lower end cover 15 which are configured to package the stator 11 and the rotor 12, wherein the rotor 12 which is concentric with the stator 11 is configured on the inner side of the stator 11, and a hydraulic cavity 13 is formed between the stator 11 and the rotor 12.

[0025] The inner wall of the stator 11 is uniformly equipped with at least one partition board groove 114 in the circumferential direction (three partition board grooves 114 are configured in this embodiment), wherein partition boards 115 are fixedly arranged in the partition board grooves 114 to equally divide the hydraulic cavity 13 into a plurality of chambers; and the outer wall of the stator 11 is equipped with a first oil port 116 and a second oil port 117 which are symmetric and located on each of both sides of each partition board 115, wherein the first oil port 116 and the second oil port 117 are communicated with the first oil way 112 and the second oil way 113 respectively.

[0026] The end surface of a flange surface 111 of the stator 11 is also equipped with a plurality of sealing grooves 118 which are distributed alternatively with the first oil ways 112 and the second oil ways 113 respectively and configured to seal the first oil ways 112 and the second oil ways 113 to avoid an oil leakage phenomenon.

[0027] The bottom of each partition board 115 is equipped with a compaction oil groove 119; when the rotor 12 rotates, hydraulic oil in the compressed chamber generates pressure, the compaction oil groove 119 applies a pressure to the partition board 115 to offset a centrifugal force generated when the partition board 115 rotates, and meanwhile, the partition board 115 is pressed towards the rotor 12, so that pre-pressing is generated between sealing rings 9 and the rotor 12 to enhance a sealing effect so as to ensure that the rotor 12 can compress the hydraulic oil when rotating relative to the rotor 12 to further generate pressure.

[0028] The circumferential surface of the outer wall of the rotor 12 is uniformly equipped with at least one blade groove 121 (three blade grooves 114 are configured in the embodiment), wherein a blade 122 is fixedly arranged in each blade groove 121, and the blades 122 and the partition boards 115 are arranged alternately.

[0029] The upper end surface of the rotor 12 is provided with an end surface sealing groove 123 in the circumferential surface, wherein an axial surface sealing groove 124 is additionally arranged on the inner wall of the rotor 12 in the circumferential direction, and PTFE (polytetrafluoroethylene) which is resistant to friction and high pressure is filled in the end surface sealing groove 123 to carry out plane sealing on the rotor 12; and polyurethane is filled in the axial sealing groove 124 to carry out axial surface rotary sealing on the rotor 12, so that the defects that the PTFE material is relatively hard, has a poor sealing effect and generates a little hydraulic oil leakage are remedied, the rotor is subjected to full sealing from two directions, namely the plane surface and the axial surface so as to ensure that no hydraulic oil leakage phenomenon exists in the rotary damper 1.

[0030] Oil suction valve mounting ports 125 which are symmetric are formed in both sides of each blade 122 and configured to suck hydraulic oil leaked from the upper plane of the stator 11 back to the chambers, so that an "oil stuffiness" phenomenon to finally cause leakage, since leaked oil generated in the plane sealing process is accumulated more and more between plane sealing and axial surface sealing, is avoided.

[0031] Sealing rings 9 are arranged on the outer surfaces of the blades 122 and the partition boards 115, between both ends of each partition board 115 and the stator 11 as well as both ends of each partition board 115 and the rotor 12, and both ends of each blade 122 and the stator 11 as well as both ends of each blade 122 and the rotor 12 so as to ensure that the rotor 12 can compress the hydraulic oil when rotating relative to the stator 11 to further generate pressure.

[0032] As shown in FIG.8, the hydraulic buffer system of the rotary damper also comprises a hydraulic integration block 10, all oil paths and valve equipment are arranged in the hydraulic integration block 10, and all the oil paths are arranged on the hydraulic integration block

10 by means of on-off of oil holes as well as geometric position arrangement and mounting of all the valves.

[0033] The control principle of the present invention is as follows:

When the rotor 12 rotates clockwise relative to the stator 11, hydraulic oil in the second cavity 132 is compressed to form a pressure-bearing cavity to generate pressure; in the meantime, the volume of a cavity body of the first cavity 13 becomes large, the cavity body internally generates a negative pressure and needs to be supplemented with hydraulic oil; at this moment, the second oil way 113 belongs to an oil discharge way, the compressed hydraulic oil enters the second oil port 117 through the second oil way 113, the second one-way valve 3 is opened, and the hydraulic oil reaches the port P of the overflow valve 6 and the port P of the proportional overflow valve 7; and when the pressure of hydraulic oil in the second oil way 113 reaches a pressure value set by the proportional overflow valve 7, the proportional overflow valve 7 is opened, the hydraulic oil reaches one end of the fourth one-way valve 5, and then the fourth one-way valve 5 is opened, the hydraulic oil enters the first oil way 12 from the first oil port, and the compressed hydraulic oil is supplemented to the cavity body of the first cavity 131.

[0034] In the same way, when the rotor 12 rotates anticlockwise relative to the stator 11, the hydraulic oil in the first cavity 131 is compressed to generate pressure; meanwhile, the volume of a cavity body in the second cavity 132 becomes large, the cavity body internally generates a negative pressure and needs to be supplemented with hydraulic oil; at this moment, the first oil way 112 belongs to an oil discharge way, so that the compressed hydraulic oil enters the first oil port 116 from the first oil way 112, the third one-way valve 4 is opened, and the hydraulic oil reaches the port P of the overflow valve 6 and the port P of the proportional overflow valve 7; and when the pressure of the hydraulic oil in the first oil way 112 reaches a pressure value set by the proportional overflow valve 7, the proportional overflow valve 7 is opened, the hydraulic oil reaches one end of the first one-way valve 2, and then the first one-way valve 2 is opened, the hydraulic oil enters the second oil way 117 from the second oil port 113, and then the compressed hydraulic oil is supplemented to the cavity body of the second cavity 132.

[0035] In a working process of the rotary damper, the pressure sensor 8 is configured to monitor of the pressure at the port P of the overflow valve 6 and the pressure at the port P of the proportional overflow valve 7 and transmit data to the electric control unit; the electric control unit is configured to correspondingly set a pressure value for the proportional overflow valve 7 according to a vehicle velocity signal sent from the vehicle and an angle signal sent from the angle sensor; the computer is configured to compare the measured pressure value at the port P of the proportional overflow valve 7 with a pressure value set by the system, and if the pressure value is slightly low, the electric control unit transmits a signal to the proportional overflow valve 7 and the proportional overflow valve 7 increases the pressure value after receiving the signal, so that the pressure at the port P reaches the set pressure value; and on the contrary, when the pressure value is slightly high, the proportional overflow valve 7 relieves the pressure after receiving the signal sent by the electric control unit, the pressure value is reduced, so that the pressure at the port P reaches the set pressure value.

[0036] When the electric control system has a fault to cause power failure of the system, the proportional overflow valve 7 is at a completely closed state, the working pressure of the rotary damper 1 is a safety pressure set by the overflow valve 6 to support the vehicle to run to a repair factory, and the pressure value of the overflow valve 6 can be manually adjusted when the basic damping force needs to be regulated in the driving process.

[0037] From the above, the hydraulic buffer system with the rotary damper is ingenious in design, high in integration level, concise and compact in structure, low in production cost and convenient to maintain and has a good buffer effect; and by means of design of the oil suction valves as well as plane sealing and axial surface sealing, the sealing effect is enhanced, and no "oil stuffiness" phenomenon is ensured.

[0038] The technical contents and the technical features of the present invention are disclosed as above, however, it is possible for those skilled in the art to make multiple substitutions and modifications, without departing from the spirit of the present invention, on the basis of teaching and disclosure of the present invention. Therefore, the protection scope of the present invention should be not limited to the contents disclosed by the embodiments and should include various substitutions and modifications without departing from the present invention and should be covered by claims of the patent application.

Claims

1. A hydraulic buffer system with a rotary damper, wherein comprises the rotary damper, a first oil path and a second oil path, and the rotary damper comprises a stator, a rotor capable of rotating relative to the stator, and a hydraulic cavity formed between the stator and the rotor; a first oil way and a second oil way are formed on the stator, and the hydraulic cavity comprises at least one first cavity and at least one second cavity which are respectively communicated with the first oil way and the second oil way; when the rotor rotates anticlockwise, hydraulic oil in the first cavity is compressed and then enters into the second cavity from the first cavity after flowing

through the first oil way, the first oil path and the second oil way; and when the rotor rotates clockwise, the hydraulic oil in the second cavity is compressed and then enters into the first cavity from the second cavity after flowing through the second oil way, the second oil path and the first oil way.

2. The hydraulic buffer system with the rotary damper according to Claim 1, wherein the buffer system also comprises a first one-way valve, a second one-way valve, a third one-way valve, a fourth one-way valve and a proportional overflow valve, wherein the second one-way valve, the proportional overflow valve and the fourth one-way valve are sequentially connected in series to form the first oil path; and the third one-way valve, the proportional overflow valve and the first one-way valve are sequentially connected in series to form the second oil path.

3. The hydraulic buffer system with the rotary damper according to Claim 2, wherein the buffer system also comprises an overflow valve and a pressure sensor; the overflow valve and the proportional overflow valve are connected in parallel and are then connected in series between the second one-way valve and the fourth one-way valve; and the pressure sensor is connected with the overflow valve and the proportional overflow valve in series and is configured to detect the pressure at a port of the overflow valve and the pressure at a port of the proportional overflow valve.

4. The hydraulic buffer system with the rotary damper according to Claim 1, wherein the rotary damper also comprises an upper end cover and a lower end cover which are configured to package the stator and the rotor.

5. The hydraulic buffer system with the rotary damper according to Claim 1, wherein the circumferential surface of the inner wall of the stator is equipped with at least one partition board groove, a partition board is fixedly arranged in each partition board groove, the outer wall of the stator is equipped with a first oil port and a second oil port which are symmetrical and are respectively located in both sides of each partition board, and the first oil port and the second oil port are communicated with the first oil way and the second oil way respectively.

6. The hydraulic buffer system with the rotary damper according to Claim 5, wherein the bottom of each the partition board groove is equipped with a compaction oil groove.

7. The hydraulic buffer system with the rotary damper according to Claim 1, wherein the end surface of the stator and the end surface of the rotor are equipped with a sealing groove respectively.

8. The hydraulic buffer system with the rotary damper according to Claim 5, wherein the circumferential surface of the outer wall of the rotor is equipped with at least one blade groove, a blade is fixedly arranged in each the blade groove, and an oil suction valve mounting port is formed in each of both sides of each blade.

9. The hydraulic buffer system with the rotary damper according to Claim 1, wherein the at least one first cavity and the at least one second cavity of the hydraulic cavity are formed by the partition boards and the blades in a spacing manner.

10. The hydraulic buffer system with the rotary damper according to Claim 1, wherein the hydraulic buffer system with the rotary damper also comprises a hydraulic integration block, and all the oil paths and valve equipment are configured in the hydraulic integration block.

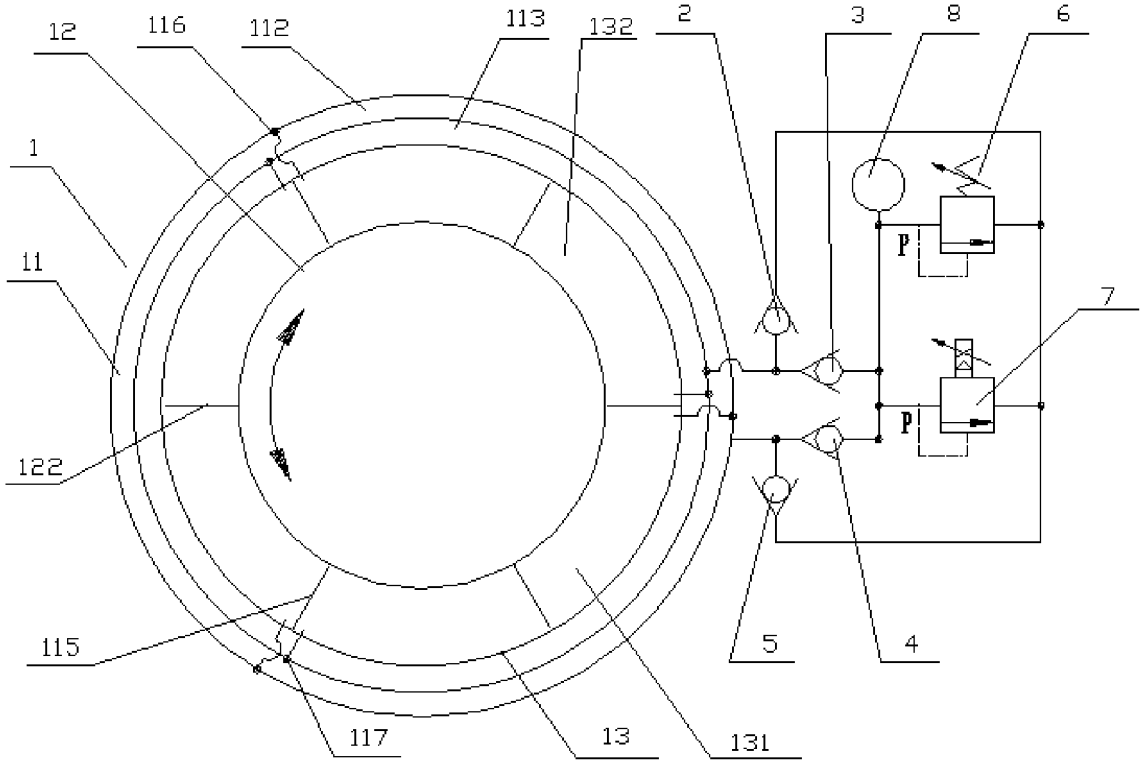

Fig. 1

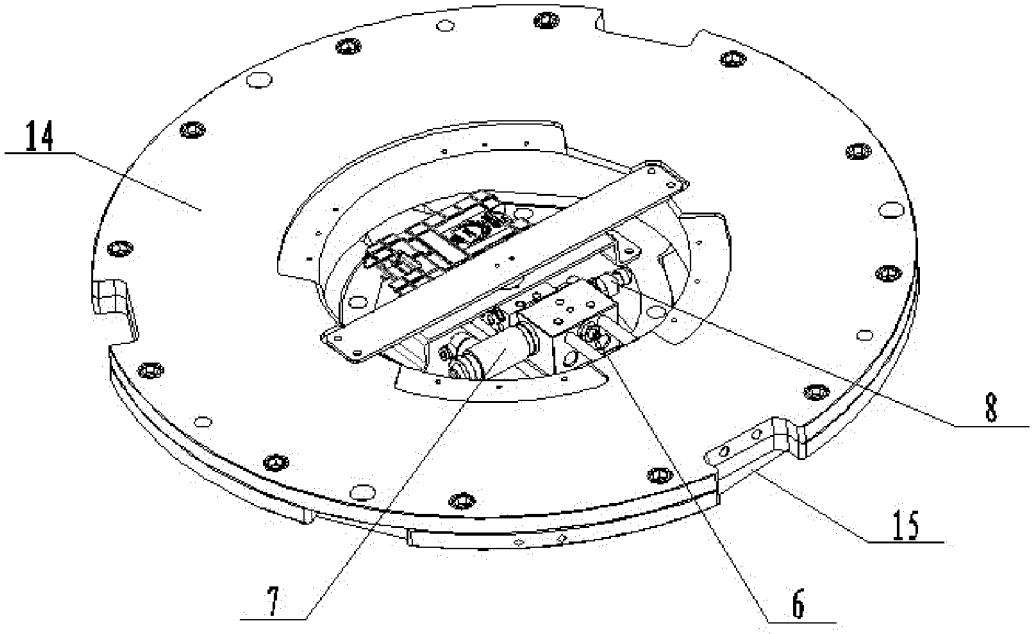

Fig. 2

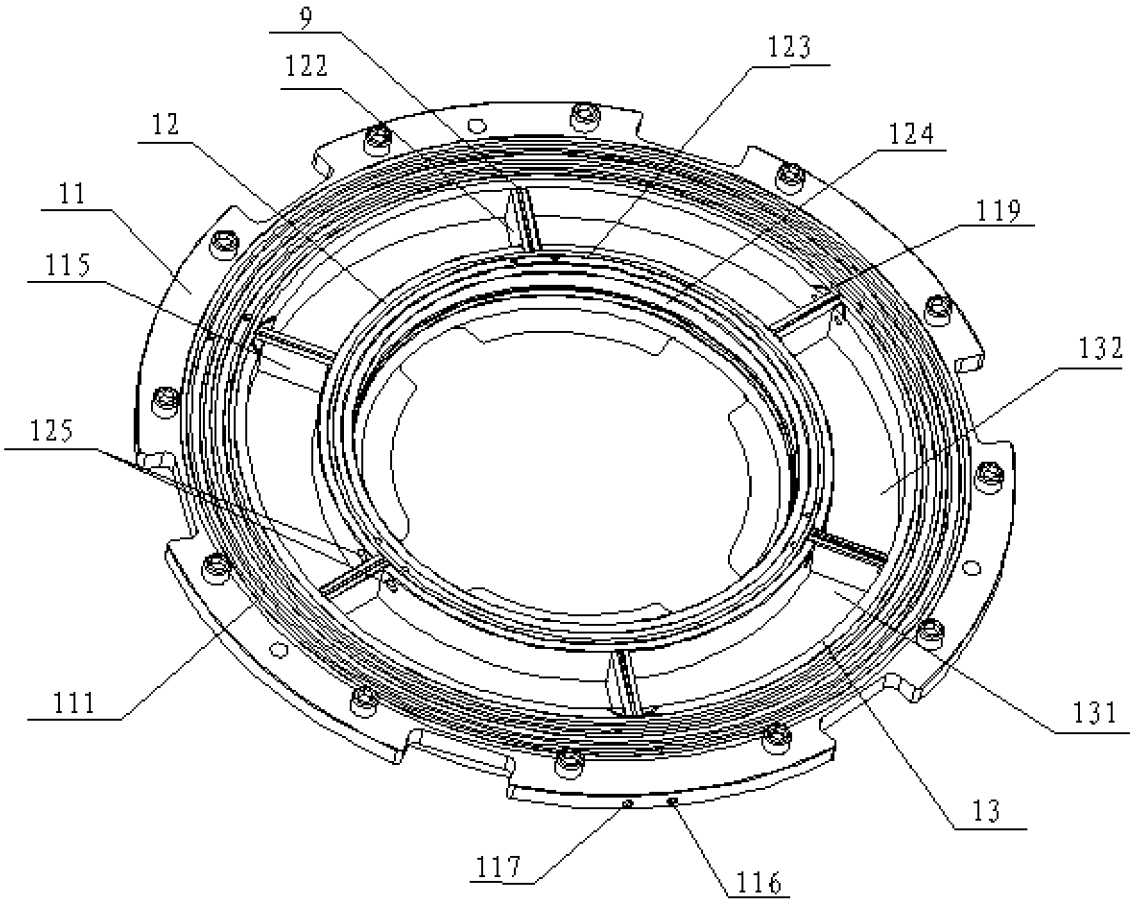

Fig. 3

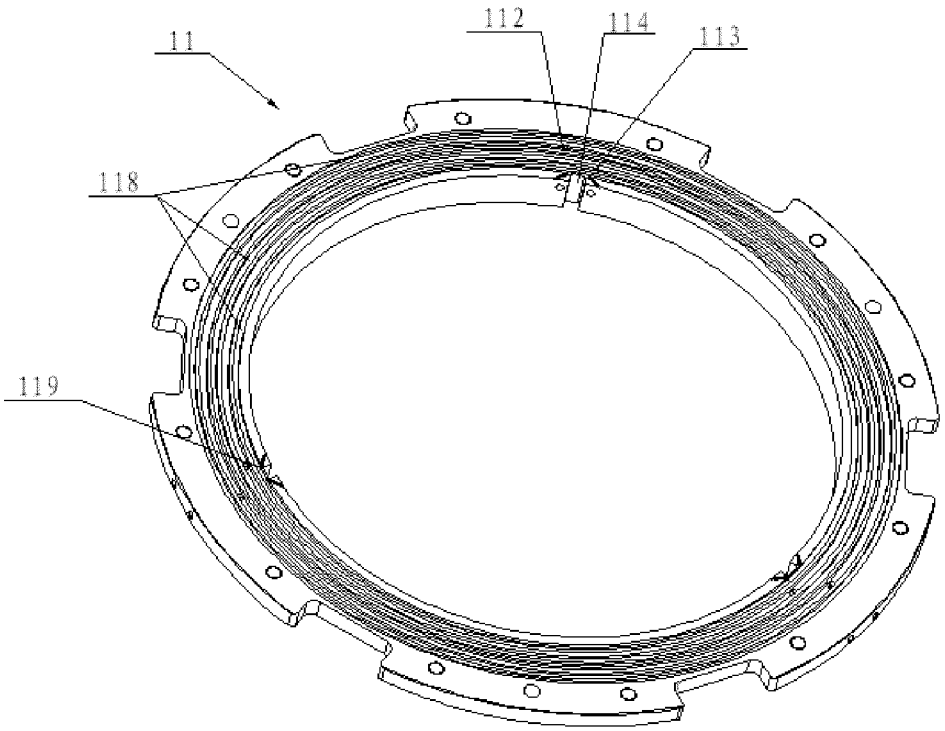

Fig. 4

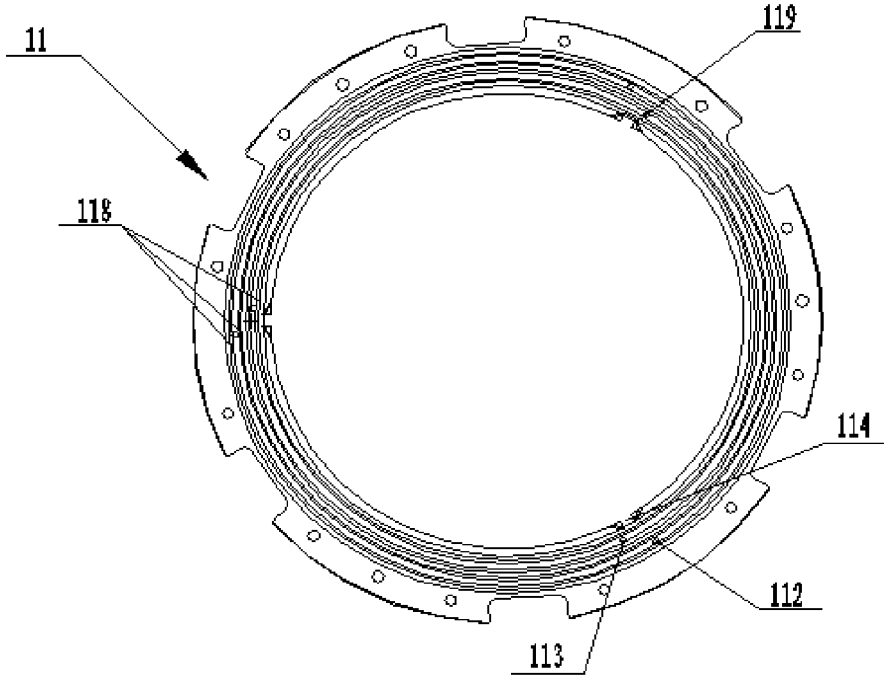

Fig. 5

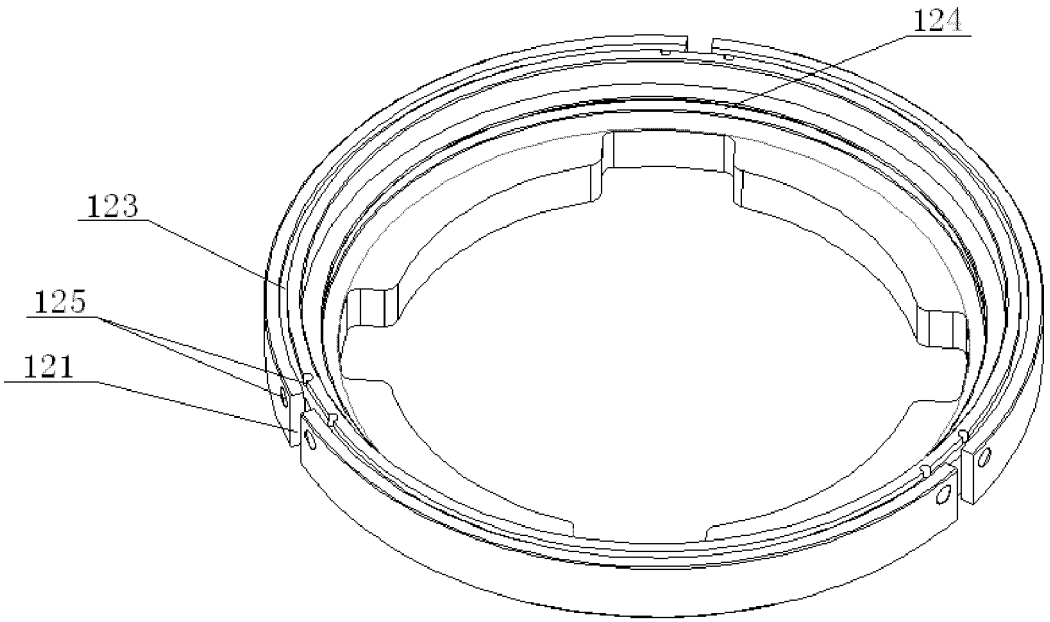

Fig. 6

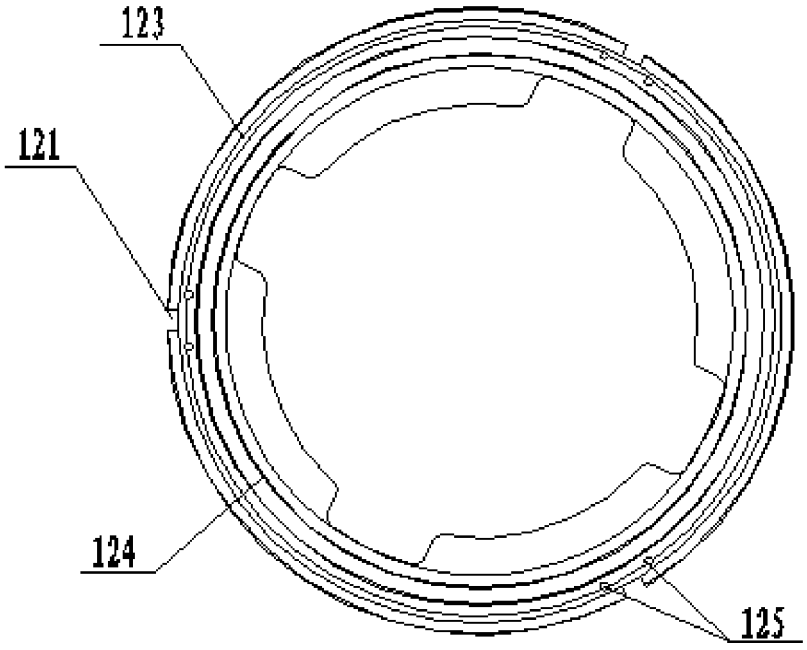

Fig. 7

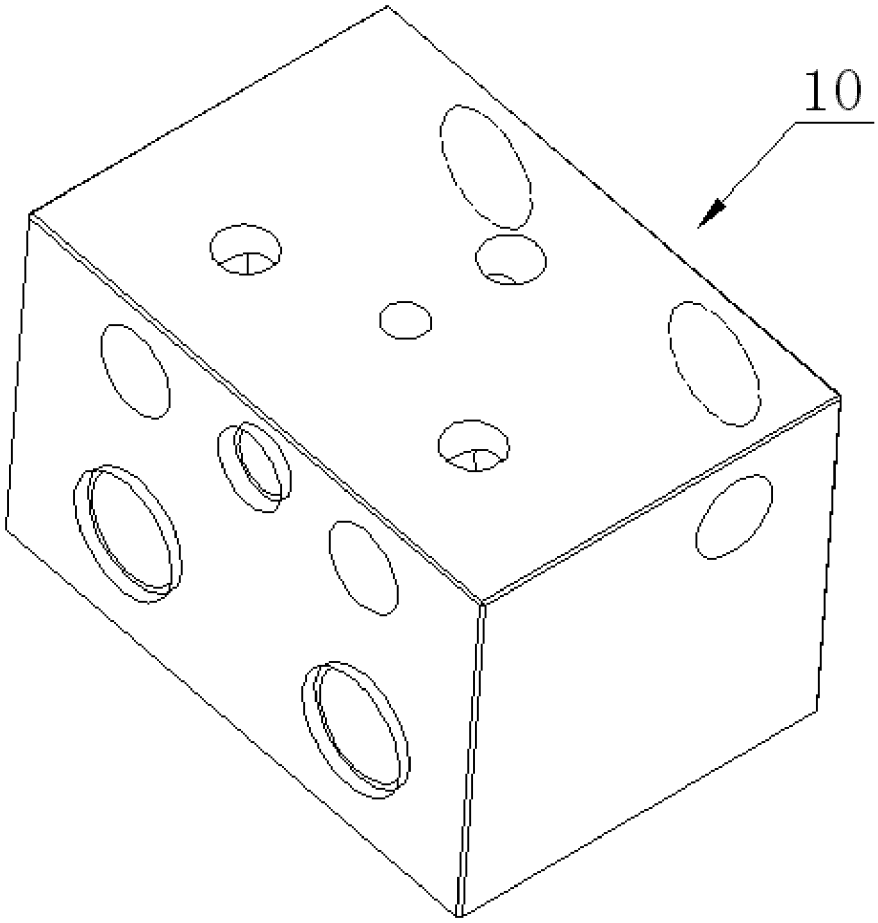

Fig. 8

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/080276

A. CLASSIFICATION OF SUBJECT MATTER

See the extra sheet
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B60D; B62D; F16F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN, CNABS, CNKI: damp+, rota+, swivel+, turn+, pivot+, joint?, coupl+, connect+, articulate+, linkage+, hydraul+, cylinder?, vehicle

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 2929022 A1 (MASCHF AUGSBURG NUERNBERG AG) 29 January 1981 (29.01.1981) see description, pages 6-8 and figures 1-3	1, 4-10
Y		2, 3
Y	US 6422584 B1 (Bittroff et al.) 23 July 2002 (23.07.2002) see the embodiment shown in figure 3	2, 3
X	WO 8401135 A1 (FALKENRIED FAHRZEUG GMBH) 29 March 1984 (29.03.1984) see the embodiment shown in figures 1 and 2	1, 4-10
Y		2, 3
PX	CN 103195855 A (JOINTECH (SUZHOU) VEHICLE SYSTEM CO., LTD.) 10 July 2013 (10.07.2013) see the embodiment shown in figures 1-8	1-10

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
08 January 2014 (08.01.2014)	23 January 2014 (23.01.2014)
Name and mailing address of the ISA State Intellectual Property Office of the P. R. China No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing 100088, China Facsimile No. (86-10) 62019451	Authorized officer YU, Xiaohuan Telephone No. (86-10) 62089256

Form PCT/ISA /210 (second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2013/080276

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
E	CN 203202106 U (JOINTECH SUZHOU VEHICLE SYSTEM CO., LTD.) 18 September 2013 (18.09.2013) see the embodiment shown in figures 1-8	1-10
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Information on patent family members

International application No.
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CLASSIFICATION OF SUBJECT MATTER

F16F 9/14 (2006.01) i
B60D 1/00 (2006.01) i
B60D 5/00 (2006.01) i
B62D 47/02 (2006.01) i
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